City University of Hong Kong
Department of Physics

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The Department of Physics at the City University of Hong Kong (CityU) has been officially launched on July 1, 2017. The Department builds on the excellent tradition of the physics faculty in the former Department of Physics and Materials Science. In the 2014 Research Assessment Exercise conducted by the Research Grants Council of Hong Kong, CityU’s physics ranked 2nd amongst all eight universities in Hong Kong. Our faculty members have received international recognition, including fellowships from prestigious societies such as the American Physical Society and the Materials Research Society.

A rigorous curriculum is a hallmark of the Department of Physics. The goal of our teaching is to equip students with knowledge and critical thinking skills that will enable them to tackle difficult physics problems throughout their career. The curriculum teaches not only foundational courses in physics, but also technology-driven courses such as computer modeling and advanced instrumentation. Our curriculum is well regarded internationally. This has allowed our students to enroll in joint degree programs with many top universities in the world, such as Columbia University in the USA, to obtain degrees from both universities.

Faculty members at the Department of Physics are committed to excellence in research. At present, the department’s research focuses on the following thematic areas:

- Computational physics and theory
- Spectroscopy and imaging
- Low-dimensional systems
- Soft matter and biophysics
- Atomic, Molecular, and Optical Physics

The Department of Physics aspires to become a leading physics department in the Asia-Pacific region.
What is Applied Physics?

The Applied Physics major is not an ordinary Physics major. In Applied Physics, students are taught biomedical physics, nuclear radiation, materials physics and photonics, paving their way to a diversified career path including medical and health care, education, engineering, commercial and industrial sectors, nuclear radiation facilities or postgraduate study.

We provide students with comprehensive knowledge and a thorough understanding of physics principles and phenomena and their applications. Students learn how to select and use appropriate and effective instrumentation techniques, to critically examine data capture methodology and the resulting data, and to evaluate the precision and reliability of the technique in use. Students may also take part in the department-based research attachment scheme which provides them an early exposure to discovery and innovation.

Final-year students are required to work independently on a project in a selected area. These projects are designed to help students integrate their knowledge to solve challenging problems. Projects may be carried out in conjunction with industries or government agencies, thus facilitating their job seeking upon graduation.

This major is the ONLY ONE in Hong Kong which trains students with medical physics and radiation protection knowledge.

Professional Accreditation

Graduates working in a field related to mechanical engineering are qualified for the Grade 1 Affiliate Membership of the Institution of Mechanical Engineers. With further professional development, a route exists for Affiliate Members to gain chartered engineer status.

Professional Career Prospects

- Biomedical Engineers
- Medical Physicists
- Environmental Consultants
- Materials Scientists
- Nuclear Technologists
- Opportunities in the Public Sector
  (e.g. the Hong Kong Observatory, the Environmental Protection Department and the Hospital Authority)

For further details about the major structure and other information, please visit our website: http://www.cityu.edu.hk/phy

Admission Route

HKDSE Students
- JUPAS
- BSc – Applied Physics (Year 1)
  - Gateway Education Courses
  - College / Department Core Courses
- Non-HKDSE Students
  - Direct Application (Non-JUPAS)
  - 13-year School-leaving Qualification Holders (e.g. IB Diploma, GCEAL)
- Associate Degree / Higher Diploma Holders

Non-JUPAS Code: 1208 BSc – Applied Physics

Admission with Advanced Standing
Depending on the qualifications, students will be admitted to Year 2 or 3 of the 4-year curriculum.

Non-JUPAS Code: 1638 BSc – Applied Physics

Admission Requirements

✓ Satisfy the General Entrance Requirements of the University with a science or engineering background; OR
✓ Associate Degree or Higher Diploma Holder in a relevant discipline or other technical qualifications; OR
✓ Other 13-year school-leaving qualification holder (e.g. IB Diploma, GCEAL)

For further details about entrance requirements and application procedures, please visit the website of our Admissions Office: http://www.admo.cityu.edu.hk/

Scholarships

In addition to the institutional and external scholarships, PHY Education Fund Scholarships (department-based scholarship) is awarded to undergraduate students with outstanding academic performance and active participation in Departmental service.
### Core Courses

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>AP1202</td>
<td>General Physics II</td>
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<tr>
<td>AP1203</td>
<td>General Physics III</td>
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<tr>
<td>AP2191</td>
<td>Electricity and Magnetism</td>
</tr>
<tr>
<td>AP2212</td>
<td>Measurement and Instrumentation</td>
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<td>AP2213</td>
<td>Advanced Measurement and Instrumentation</td>
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<tr>
<td>AP3114</td>
<td>Computational Methods for Physicists and Materials Engineers</td>
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<td>AP3202</td>
<td>Modern Physics</td>
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<td>AP3204</td>
<td>Waves and Optics</td>
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<td>AP3205</td>
<td>Electromagnetism</td>
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<td>AP3244</td>
<td>Design Laboratory</td>
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<td>AP3251</td>
<td>Quantum Physics</td>
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<tr>
<td>AP3272</td>
<td>Introduction to Solid State Physics</td>
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<tr>
<td>AP3290</td>
<td>Thermodynamics</td>
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<tr>
<td>AP4116/</td>
<td>Dissertation/</td>
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<td>AP4116/</td>
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<td>AP4217/</td>
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<tr>
<td>FS4003</td>
<td>CES Placement Project</td>
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<td>MA2158</td>
<td>Linear Algebra and Calculus</td>
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### Elective Courses

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<th>Course Code</th>
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<tr>
<td>AP2102</td>
<td>Introduction to Materials Engineering</td>
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<tr>
<td>AP3171</td>
<td>Materials Characterization Techniques</td>
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<tr>
<td>AP3206</td>
<td>Nuclear Radiation and Detection</td>
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<tr>
<td>AP3240</td>
<td>Biological Physics</td>
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<tr>
<td>AP3242</td>
<td>Directed Studies in Physics/Materials Engineering</td>
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<td>AP4121</td>
<td>Thin Film Technology and Nanocrystalline Coatings</td>
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<td>AP4127</td>
<td>Sensors: From Engineering to Applications</td>
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<td>AP4172</td>
<td>Simulation and Modelling in Multidisciplinary Sciences</td>
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<td>AP4230</td>
<td>Radiation Safety</td>
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<td>AP4232</td>
<td>Radiotherapy Physics</td>
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<td>AP4233</td>
<td>Imaging Physics</td>
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<td>AP4250</td>
<td>Fundamentals of Laser Optics</td>
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<td>AP4255</td>
<td>Optoelectronic Devices and Systems</td>
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<td>AP4265</td>
<td>Semiconductor Physics and Devices</td>
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<td>AP4271</td>
<td>Environmental Radiation</td>
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<td>AP4272</td>
<td>Environmental Radiation Measurements</td>
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<td>AP4273</td>
<td>Special Topics in Physics</td>
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<td>AP4274</td>
<td>Radiation Biophysics</td>
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<td>AP4275</td>
<td>Radiological Physics and Dosimetry</td>
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<td>AP4280</td>
<td>Advanced Optics Laboratory</td>
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<td>AP4282</td>
<td>Physical Optics</td>
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<td>AP4283</td>
<td>Medical Physics I</td>
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<td>AP4284</td>
<td>Medical Physics II</td>
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*Course offering subject to change

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**City University of Hong Kong**

**Columbia University**

**A Brand New College Experience**

The Joint Bachelor's Degree Program between City University of Hong Kong and Columbia University offers students an international undergraduate educational experience—a program spanning two continents, in cosmopolitan cities that allow students to engage directly with the world around them. The program draws upon elements both traditional and innovative, combining the academic rigor of two world-renowned universities with an attention to the roles that social and cultural traditions play in a student's intellectual formation.

Second Year applied physics major students (normative 4-year degree) with outstanding academic performance may apply for the Joint Bachelor's Degree program.

To learn more about the Joint Bachelor's Degree Program, visit gs.columbia.edu/cityu-hk.
Student Highlights

Cheng, Yuanhao
BSc Applied Physics, CityU
Joint Bachelor’s Degree Program between CityU and Columbia University

Columbia University is a prestigious university. I have had the chance to interact with many brilliant professors and students. Courses at Columbia are very demanding, but also very enlightening. I have spent a great deal of time reading books, understanding materials, and doing homework. By my self-study and through my discussions with professors and students, I have been able to easily learn whatever I want. A number of libraries are located on campus, and each of them is furnished in a distinctive style. I have greatly enjoyed the time I’ve spent in each one learning and meeting people.

Song, Yuan
BSc Applied Physics, CityU
Joint Bachelor’s Degree Program between CityU and Columbia University

The Joint Bachelor’s Degree Program has allowed me to be engaged in two elite universities in two fascinating cities. Columbia University sees the entire city as its campus. Things that I can do in New York are far beyond my imagination. I’ve met every actor in the play *Sleep No More* inside the 5-storey Mckitrick Hotel. I’ve spent weeks in the Metropolitan Museum of Art to admire history. I have shaken hands with the current World Chess Champion, Magnus Carlsen. New York is a place that is full of possibilities, no matter who you are. All the assignments that I found challenging [at Columbia] were more inclined to theoretical fields, designed to enhance my understanding of physics, which created a balance comparing to those more experimentally-focused courses at CityU. Having resources at both universities available, I became much more confident in the field of physics.
Innovative Learning Inspiring Discoveries

Student Exchange
- University of Illinois at Urbana-Champaign, USA
- Umea University, Sweden
- University of Toronto, Canada
- University of Maryland, USA

Study Tour
- Japan
- Singapore

Project Exhibition
- Final Year Student Project Exhibition

Undergraduate Research Attachment Scheme
- Early Research Exposures as Young Scientist

Other Activities
- Visiting PCCW MCX10 Data Center
- Visiting HKT Network Operating Centre
- Mainland Enterprise Visit
- Industrial Exposures

Departmental Tea Gathering for Students
- Departmental Seminar by Prof. Serge Haroche, the 2012 Nobel Laureate in Physics
- Career Talk
The Department supports both MPhil and PhD studies in the following areas:

1. Theory and Computational Physics
2. Spectroscopy and Imaging
3. Atomic, Molecular and Optical Physics
4. Soft Matter and Biophysics
5. Low-Dimensional Systems

For further details about the existing MPhil/PhD Research Projects, programme structure and other related information, please visit our website: http://www.cityu.edu.hk/phy

Entrance Requirements

Candidates for the MPhil degree should hold a relevant bachelor’s degree with first or second class honours (or equivalent qualification) from a recognized university, or hold a taught master’s degree (or equivalent qualification) from a recognized university.

Candidates for the PhD degree should hold a higher degree by research (or equivalent qualification) from a recognized university, or be a current MPhil student in the University who is seeking transfer to PhD candidature.

Applicants from an institution where the language of teaching is not English should satisfy the minimum English proficiency requirements specified by both the University and College.

While priority will be given to candidates holding an MPhil degree or a taught master’s degree with research component for PhD studies, candidates holding a good bachelor’s degree or a taught master’s degree may be considered for either MPhil or direct entry to PhD studies.

Application Procedures

Students interested in any of these projects or related field should contact and discuss with their potential supervisors. The applicant is advised to obtain the consent of one of the academic staff members to be his/her supervisor before submitting the application.

For further details of application procedures, please visit the website of Chow Yei Ching School of Graduate Studies: http://www.sgs.cityu.edu.hk/prospective/rpg/

Hong Kong PhD Fellowship

Applicants who could demonstrate outstanding qualities of academic performance, research ability / potential, communication and interpersonal skills, and leadership abilities are encouraged to apply for admission through “Hong Kong PhD Fellowship Scheme”.

For further details about this scheme, please visit http://www.sgs.cityu.edu.hk/prospective/RPy/HKPhD

Financial Support

- Applicable to government-funded students only
  > Postgraduate Studentship
  > Research Tuition Scholarship
  > Conference Grant

- Applicable to all students
  > Government Grants and Loans
  > External Financial Awards/Assistance

For further details about this studentship, please visit http://www.sgs.cityu.edu.hk/prospective/rpg

Research Areas

Theory and Computational Physics

Condensed matter theory to study quantum transport, correlated electrons, spintronics and optical processes; Computational solid state physics to study structural, electronic, exciton, phonon and magnetic properties of novel systems such as topological and 2-dimensional systems; Computational chemistry to develop and use quantum mechanical methods to calculate the structures and properties of molecules; Computational biology physics to illuminate the structures and function of supramolecular systems in the living cell; Quantum simulation and information; Quantum simulation with cold atoms.

Spectroscopy and Imaging

Sophisticated experiments involving quantum beams such as synchrotron x-ray, neutron, electron, coherent light, and NMR to determine the structure and dynamics of materials; The structure and phase transition in glass and liquids; Boson peak and the dynamics of glass and liquids; Quantum interactions such as spin-orbital coupling in multiferroics.

Atomic, Molecular and Optical Physics

Mechanism of noise and decoherence; Open quantum system and quantum entanglement; Non-equilibrium physics in AMO system; Topological quantum computing and Majorana fermions; Dirac and Weyl semimetals; Topological and dynamical phenomena; Bose-Einstein condensation and spin-orbit coupling.

Soft Matter and Biophysics

Dynamics of protein and subcellular processes (DNA, RNA, membrane); Emergent phenomena in live cells with single molecule sensitivity; Non-equilibrium mechanisms in active living matter; Biological networks; Biological and clinical experiments; Novel physics-based data acquisition protocol and instrumentation in biomedical imaging.

Low-Dimensional Systems

Quantum Hall Effect; Transport phenomena; Superconductivity; Frustrated magnetism; Topological superconductors; Graphene; 2D materials beyond graphene, heterostructures and interfaces.
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Lan, S, Ren, Y, Wei, XY, Wang, B, Gilbert, EP, Shibayama, T, Watanabe, S, Ohnuma, M & Wang, XL 2017, 'Hidden amorphous phase and reentrant supercooled liquid in Pd-Ni-P metallic glasses' Nature Communications, vol 8, 14679. DOI: 10.1038/ncomms14679

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